Relationships among Metals Criteria, Ambient Bioassays, and Community Metrics in Metals-Impaired Streams

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If bioassessments are to help the Office of Water, the Regions, and the States to diagnose causes of stream impairments, a better understanding is needed of the relationship between community metrics and ambient criteria or ambient bioassays. This relationship is not simple because metrics assess responses at the community level of biological organization, while ambient criteria and bioassays assess or are based on responses at the individual level. For metals, the relationship is further complicated by the influence of other variables, such as hardness, on their bioavailability and toxicity. In 1993 and 1994, a R-EMAP survey was conducted on streams in Colorado's Southern Rockies Ecoregion. In this ecoregion, mining has resulted in metals contamination of streams. The surveys collected data on fish and macroinvertebrate assemblages, physical habitat, and sediment and water chemistry and toxicity. These data provide a framework for assessing diagnostic community metrics for specific environmental stressors. We characterized streams as metals-impaired based on exceedence of hardness-adjusted metals criteria (Cd, Cu, Pb, and Zn) in water; on water toxicity tests (48-hour *Pimephales promelas* and *Ceriodaphnia dubia* survival); on exceedence of sediment TELs; or on sediment toxicity tests (seven-day *Hyalella azteca* survival and growth). Macroinvertebrate and fish metrics were compared among affected and unaffected reaches to identify metrics sensitive to metals. Several macroinvertebrate metrics, particularly richness metrics, were less in impaired streams, while other metrics were not. This is a function of the sensitivity of the individual metrics to metals effects. Fish metrics were less sensitive to metals because of the low diversity of fish in these streams.